P3 Project Risk Assessment

P3-VALUE Webinar – June 13, 2013

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FHWA's P3 Toolkit

- The P3 Toolkit provides educational tools and guidance documents to enhance the capacity of public sector decision-makers to analyze procurement options
- Will address four key phases of P3 implementation:
  1. Legislation and policy
  2. Planning and evaluation
  3. Procurement
  4. Monitoring and oversight

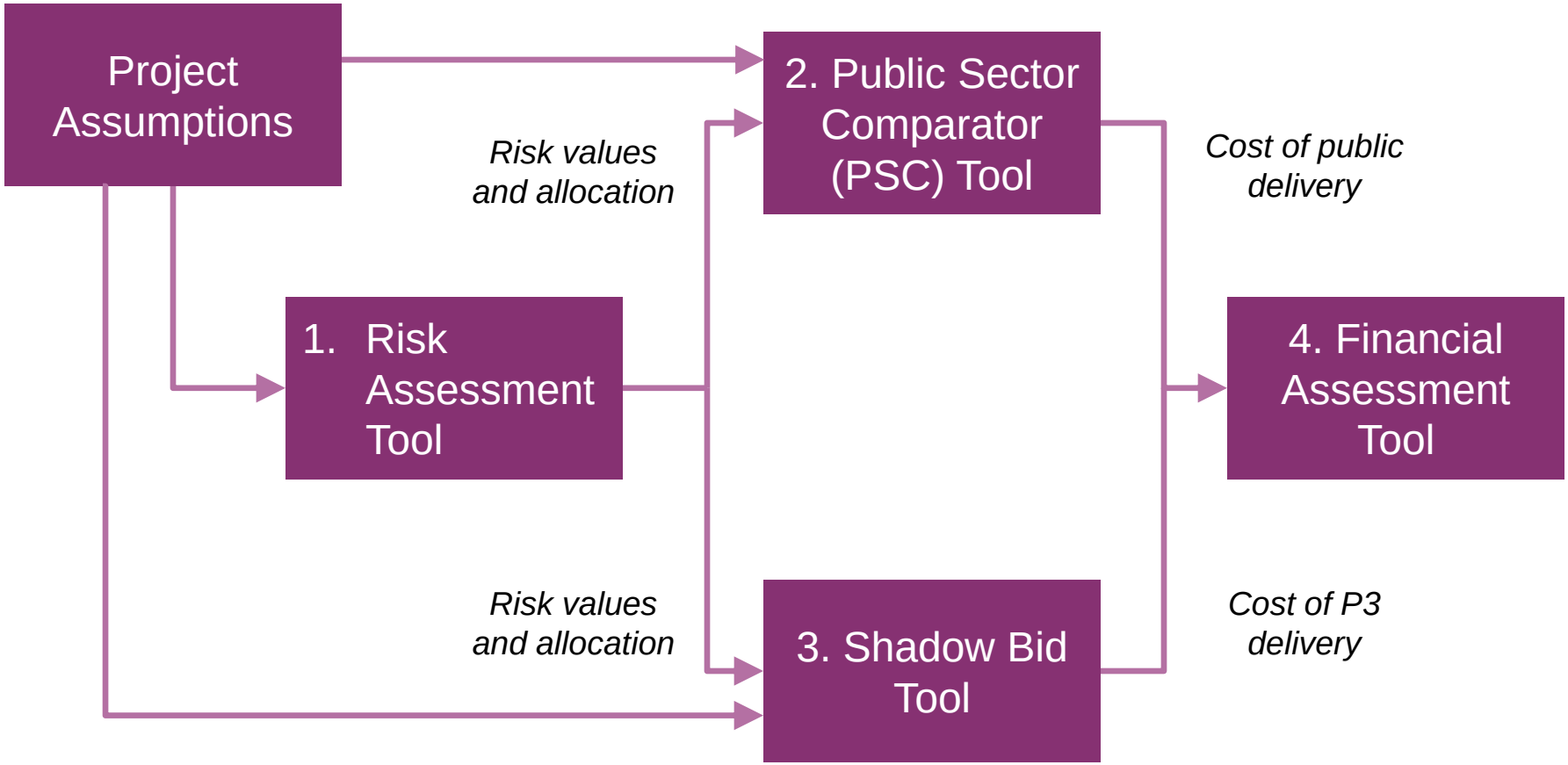
P3-VALUE Webinars

- **P3-VALUE:** Suite of four integrated analytical tools and supporting documentation to help practitioners understand processes used to quantitatively evaluate P3 options
- This is the second of four webinars on P3-VALUE
  - P3 Evaluation Overview (May 2) – recording available at https://connectdot.connectsolutions.com/p552kqd0pxs/
  - **P3 Project Risk Assessment** (today)
  - Value for Money Analysis (July 11)
  - Financial Structuring and Assessment (August 7)

P3-VALUE Tools

- **Risk Assessment Tool**
  - Identifies risks, risk allocation, risk response strategies, potential cost and schedule impacts
- **Public Sector Comparator (PSC) Tool**
  - Estimates risk-adjusted life cycle costs of conventional procurement
- **Shadow Bid Tool**
  - Estimates costs of P3 procurement, including payments to private partner
- **Financial Assessment Tool**
  - Compares PSC and Shadow Bid costs to calculate value for money

P3-VALUE Tools



P3-VALUE Tools are accessible at:
http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm

Risk Assessment Tool

Purpose

- To identify risks, risk allocation, risk response strategies, potential cost and schedule impacts of project risks
- To estimate value of retained and transferrable project risks

Prerequisites

- Project preliminary design, scope, and alignment
- Estimated schedule, procurement options, and life cycle costs

Course Outline

Course Objectives

After taking this course you should be able to:

- Describe the various transportation project delivery models
- Identify types of risks in the life cycle of a major project
- Explain the methods for quantifying and monetizing the value of individual risks
- Describe how financial impacts of risks are incorporated into Value for Money analysis
- Access the tools and supporting information

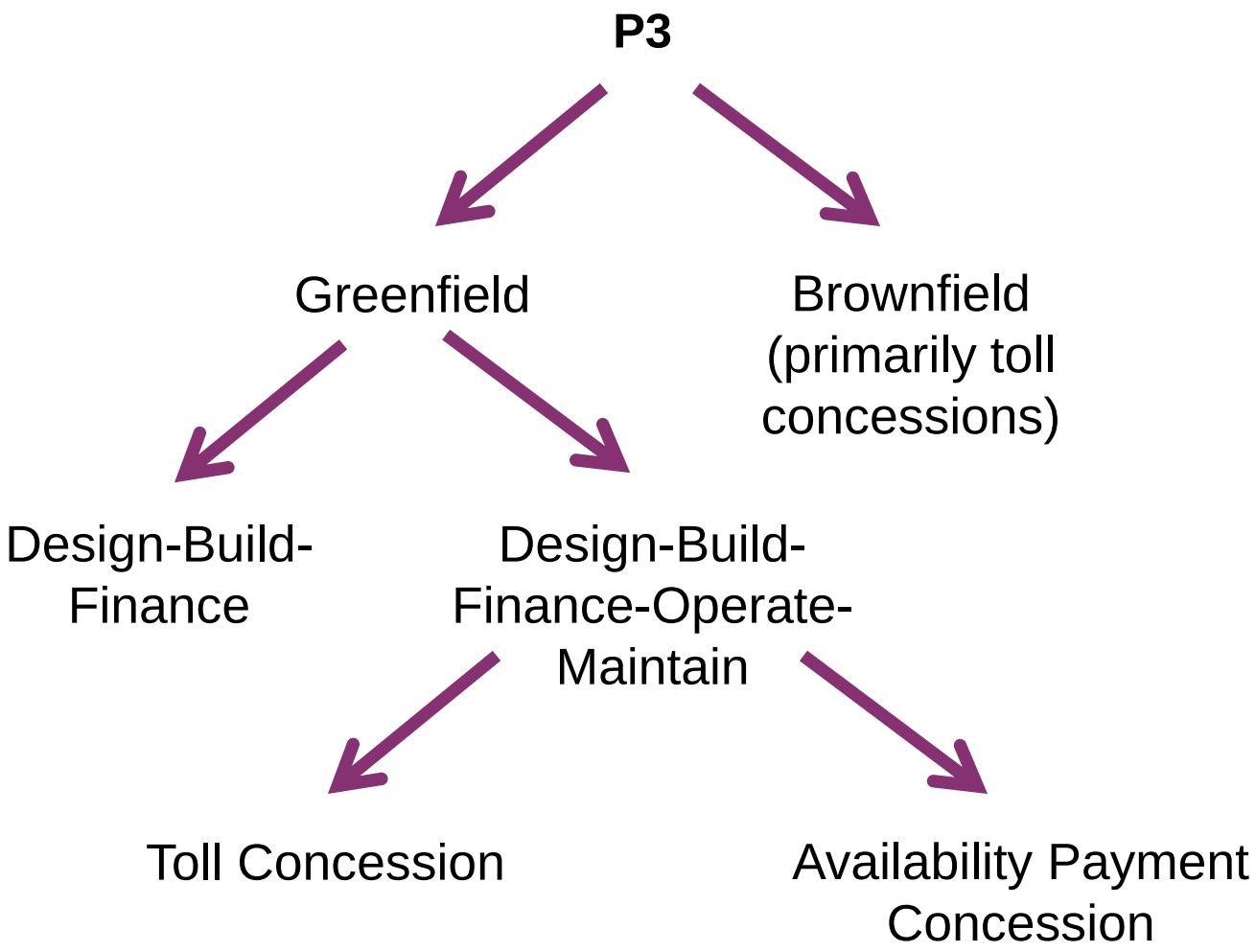
Lesson 1

P3s and Risk

What is a P3?

- **Acronym:** Public-private partnership (P3 or PPP)
- **Definition:** Contractual agreement between a public agency and a private entity covering more than a single project phase or function
- **Purpose:** To allow private participation in the delivery and financing of transportation projects *when it creates greater value and is in the public interest*

Common Types of P3s



Potential Benefits and Drawbacks

Potential Benefits

- Additional Financial Capacity
  - Gap financing accelerates project delivery
  - Conserves public sector debt capacity
- Lifecycle Cost Efficiencies
  - Creates incentives to manage lifecycle costs
  - Integrates project phases creating efficiencies
- Risk Transfer
  - Budget and cost certainty
  - Improved risk management reduces costs

Potential Drawbacks

- Loss of flexibility of public agency
  - Changing priorities
  - Integration of facility into the wider network
- Increased financial costs
  - Higher cost for private capital
- Complex procurement process
  - Higher costs for procurement
  - Need for P3 expertise to conduct negotiations

Types of Project Risks

- Design-Build phase
  - Site – right-of-way acquisition, ground condition, utilities, permits, archaeological, etc.
  - Construction – design, change orders, weather, price adjustments, latent defect, etc.
- Operations phase
  - Demand/ revenue – traffic, appropriations, etc.
  - Performance – latent defect, inflation, regulation, etc.
- General risks
  - Political – opposition, changes in law or administration
  - Economic – inflation, interest rates
  - Other – force majeure, environmental permitting and approvals

Financial Impacts of Project Risks

- Costs
  - Capital and O&M
- Schedule
  - Delays impact costs as well as revenues
- Revenue
  - Reduced toll revenue or availability payments

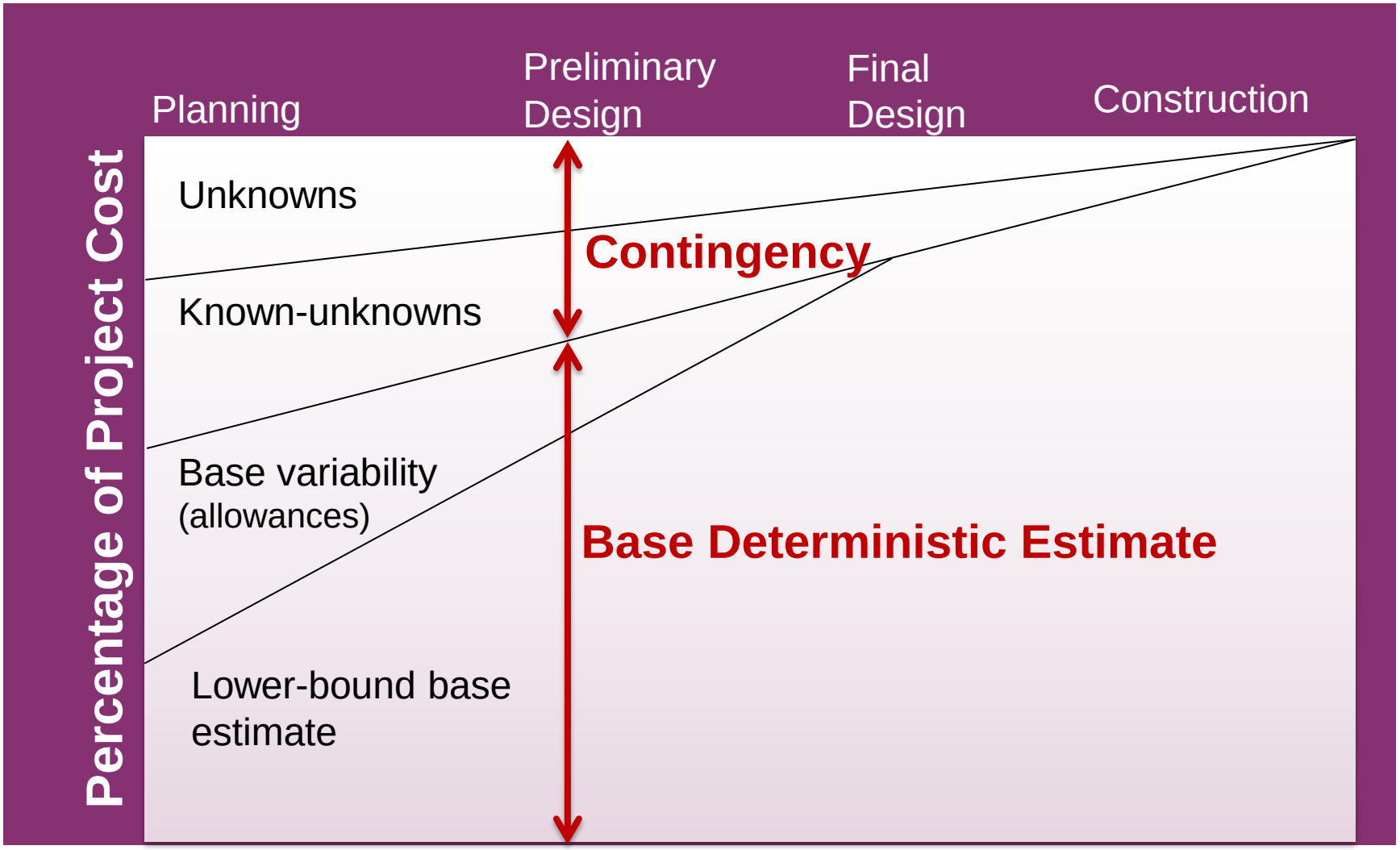
Purpose of Risk Assessment in P3s

- To calculate value of risks transferred to private sector and retained by public sector for ***value for money*** analysis
- To design technical requirements and commercial terms prior to developing ***draft agreement*** for RFP
- To assist in ***negotiation*** with bidders over the allocation and pricing of risk
- To develop ***risk management plans*** and reporting requirements

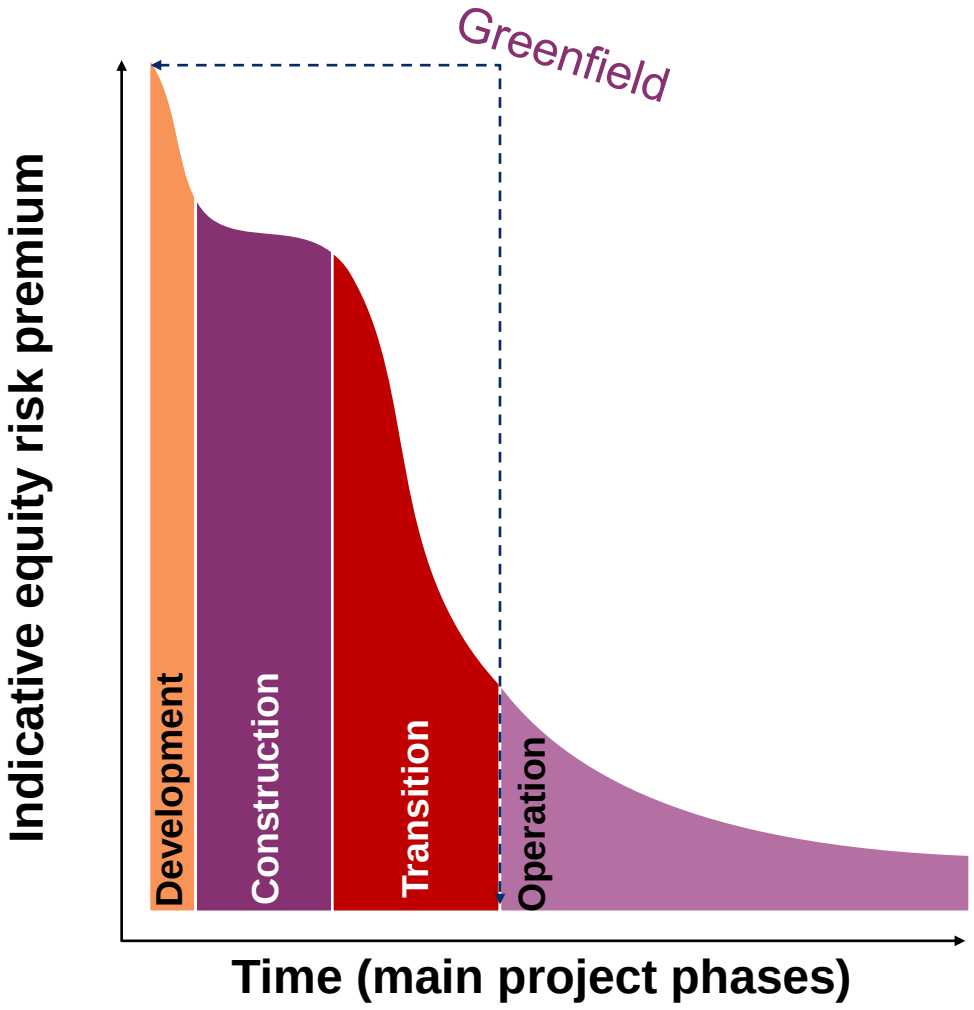
Construction Phase Uncertainties

- **Base Variability** – inherent uncertainty not caused by risk events
  - Function of level of design & estimation process
  - We know it's going to happen, but don't have enough information to estimate the cost accurately
- **Risk**– an uncertain event or condition that, if it occurs, has a *negative or positive* effect on project's costs, schedule or revenues
  - Negative impacts: threats
  - Positive impacts: opportunities
  - Two types:
    - Known unknowns – "It might happen, but at least we are aware of it."
    - Unknowns – "We didn't see that coming."
  - Function of level of design & estimation process

Construction Cost Uncertainty



Risk Magnitude over Concession Term



Audience Feedback

On average, how much contingency does your agency include in cost estimates to account for risk in the planning phase? In the design phase?

- None
- 0 – 2 percent
- 2 – 5 percent
- 5 – 10 percent
- 10 – 15 percent
- More than 15 percent
- Not sure

Questions?

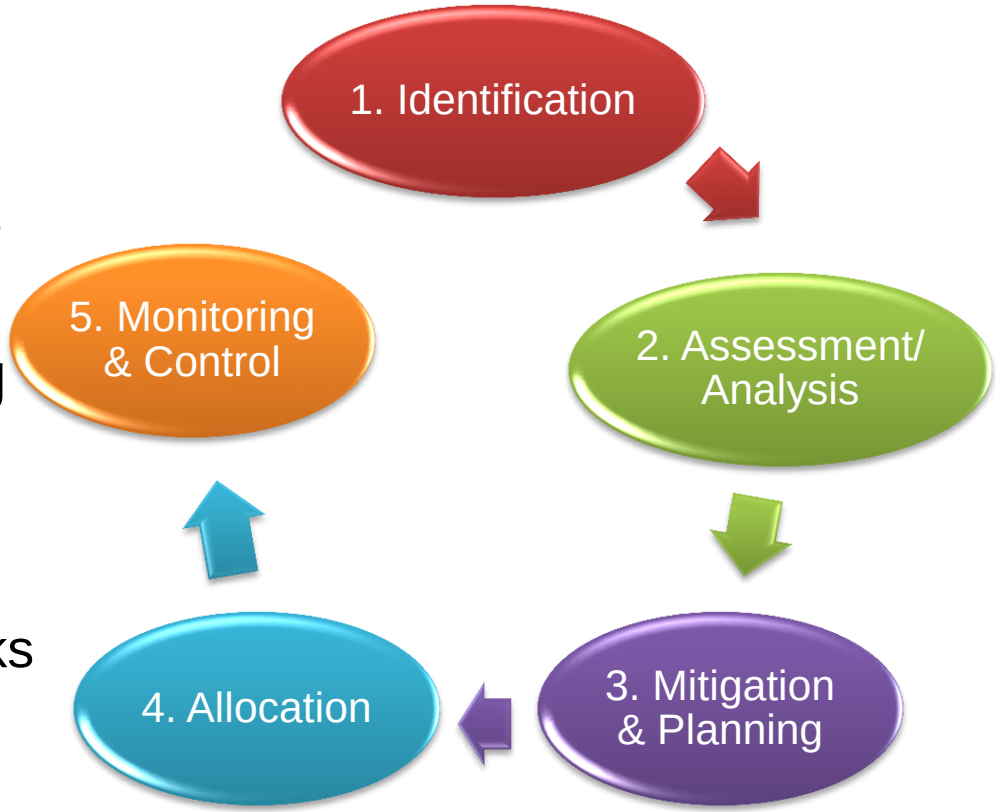
Submit a question using the chat box

Lesson 2

Risk Management Process

Risk Management Process Overview

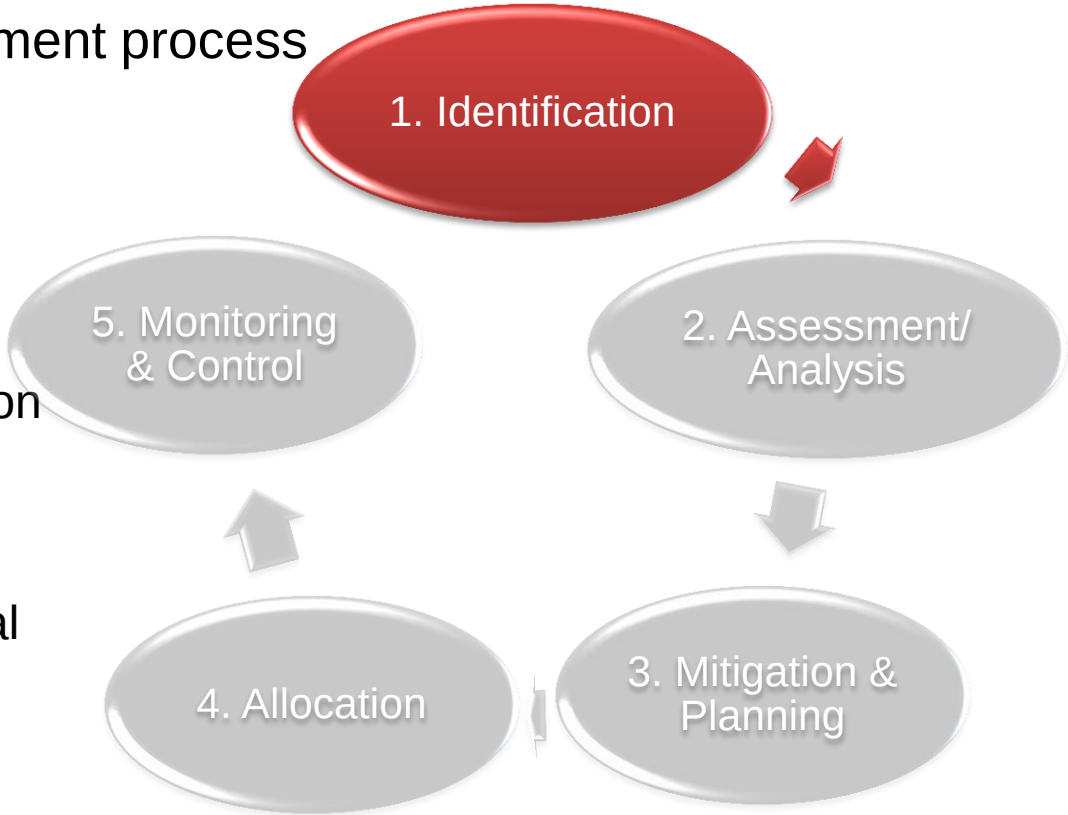
1. Identification
   - Type & timing of risk
2. Assessment & Analysis
   - Probability & consequence of risk
3. Risk Response Planning
   - Minimization of risk impact
4. Allocation
   - Transfer of appropriate risks
5. Monitoring & Control
   - Ongoing oversight of risks



1. Risk Identification

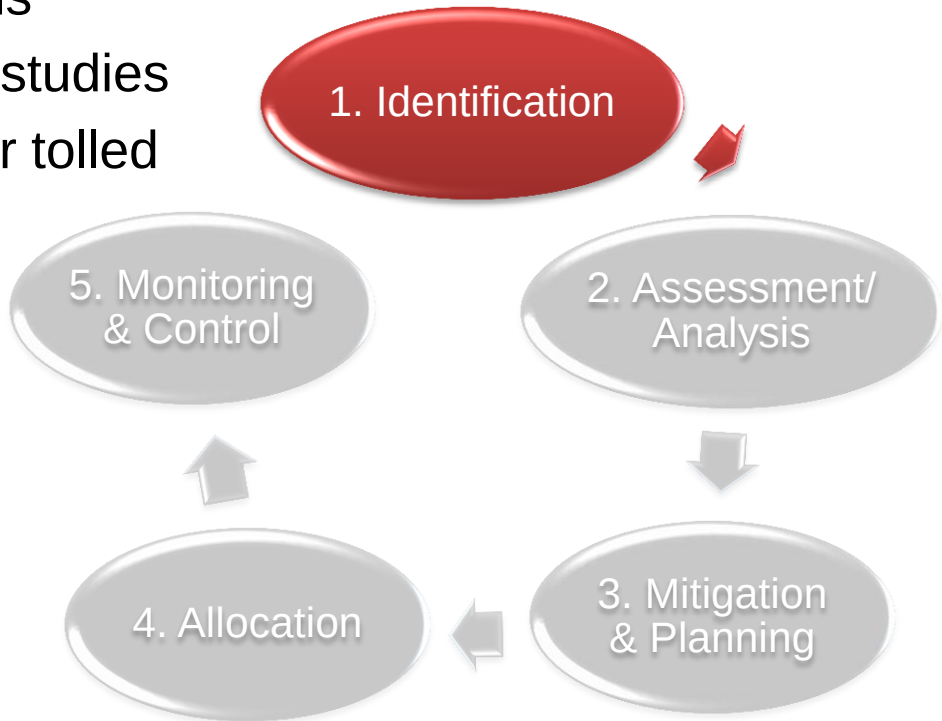
Risk Workshops

- When?
  - Early in project development process
- Who?
  - Facilitator
  - Subject matter experts:
    - Design and Construction Engineering
    - Environmental
    - Geological/Hydrological
    - Financial
    - Policy/Planning



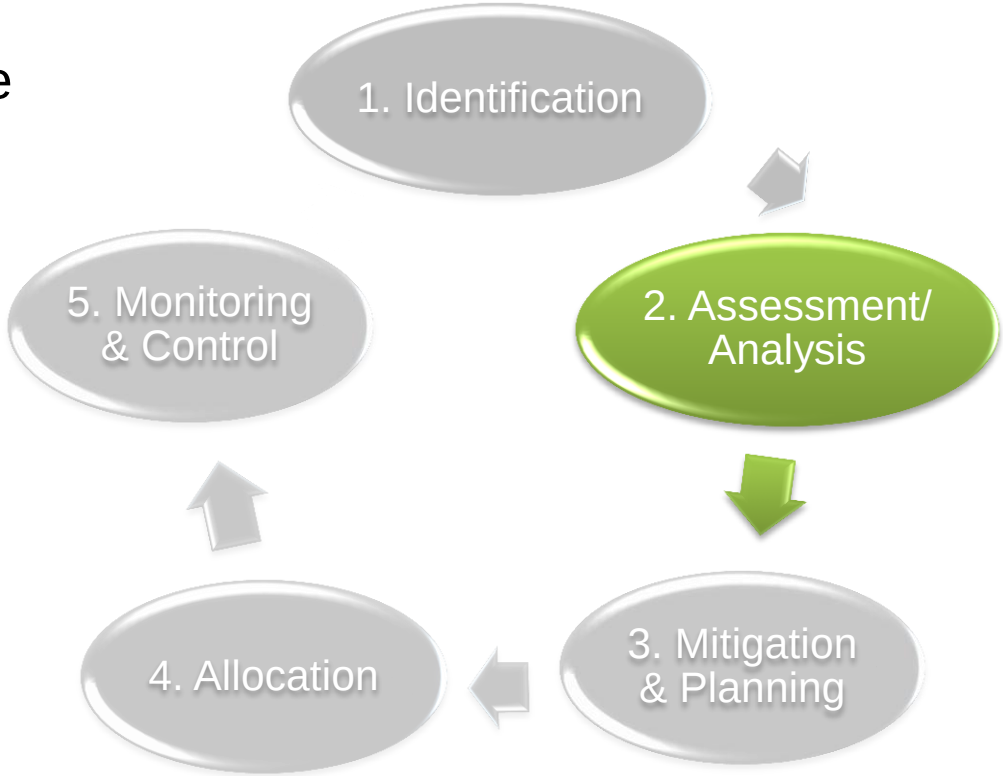
1. Risk Identification (Cont.)

- What information is needed?
  - Defined project scope and preliminary design
  - Potential procurement options
  - Planning and environmental studies
  - Traffic and revenue study (for tolled projects)
- What tools are used?
  - Risk Checklist
  - Risk Register



2. Risk Assessment & Analysis

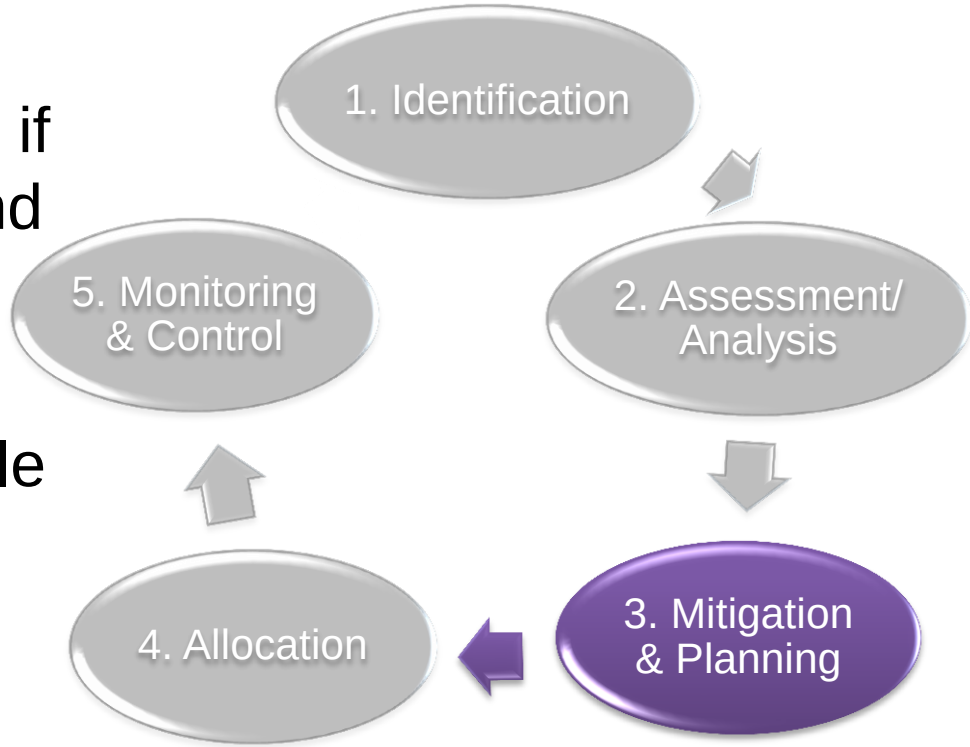
- Calculating the Value of Risk
  - Probability x Consequence
- Potential Consequences
  - Cost
  - Schedule
  - Revenue
- Types of Assessments
  - Qualitative
  - Quantitative



3. Risk Response Planning

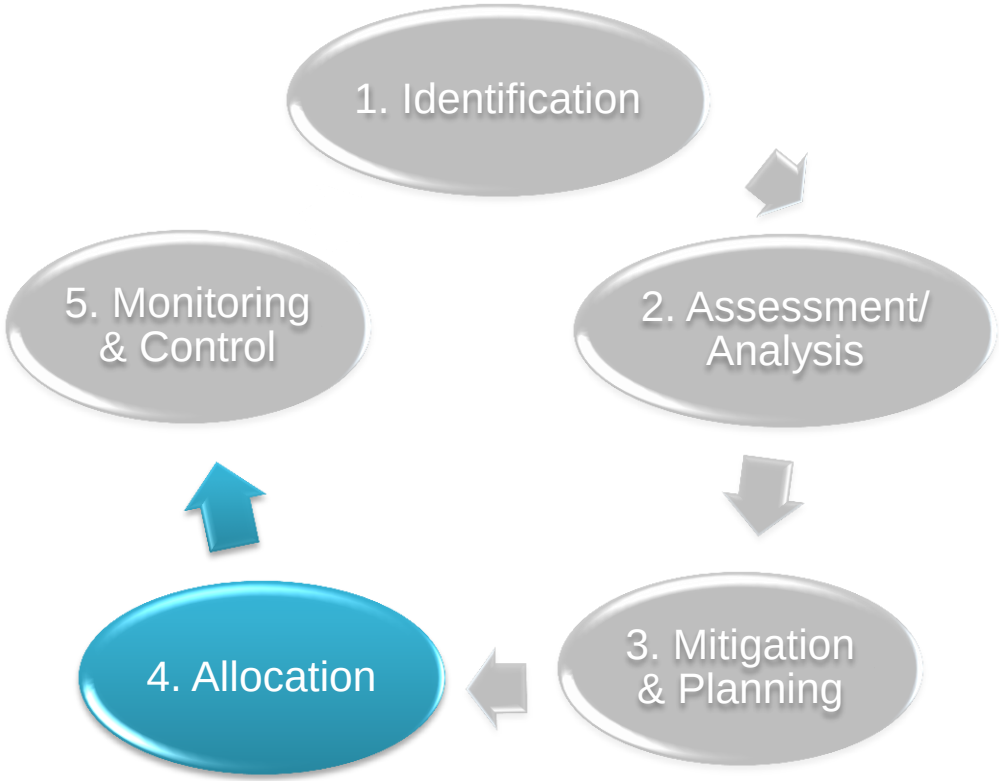
Risk Response Strategies

- **Avoid**: Reduce probability of risk event occurring
- **Mitigate**: Reduce consequence of risk event if it does occur (both cost and time)
- **Transfer/Share**: transfer risk to a party more capable of (or willing to) managing the risk



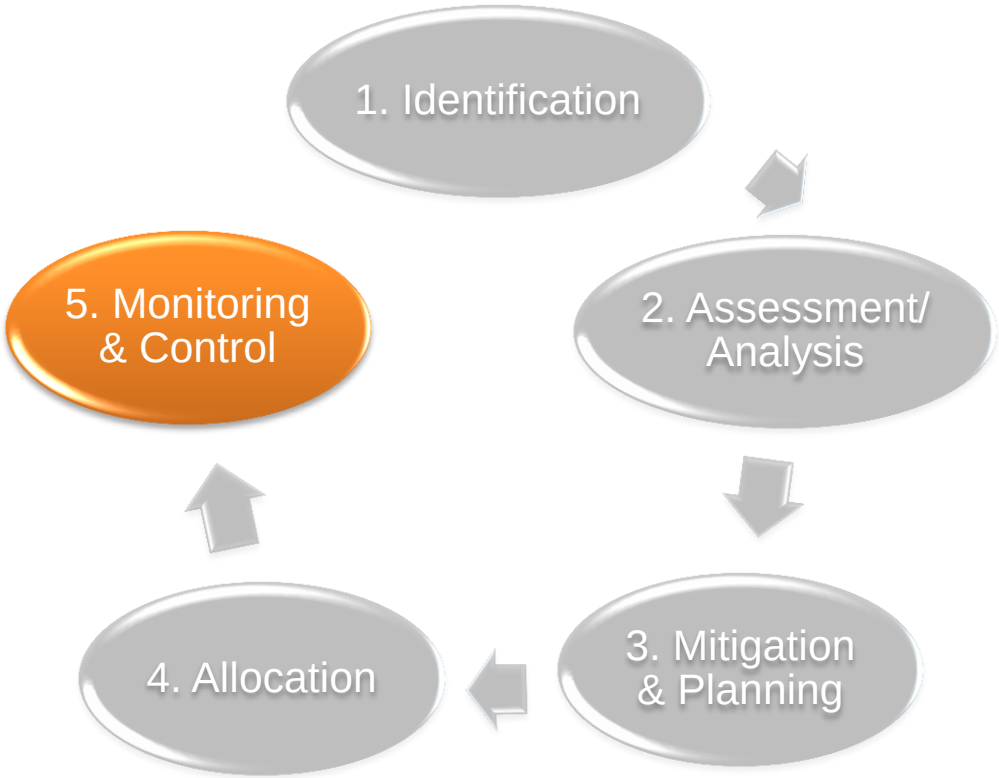
4. Risk Allocation

- Transferrable Risks
- Retained Risks
- Shared Risks



5. Risk Monitoring & Control

- Revisit risk register as risks become clearer
- Use performance metrics to monitor risk
- Understand P3 agreement and negotiated risk management provisions
- Avoid taking back transferred risks



Audience Feedback

In your view, which of the following risks may be managed at lower cost by the private sector?

- Environmental
- Land acquisition
- Utilities
- Financial
- Design/geotechnical
- Construction
- Traffic/revenue
- Operation/maintenance

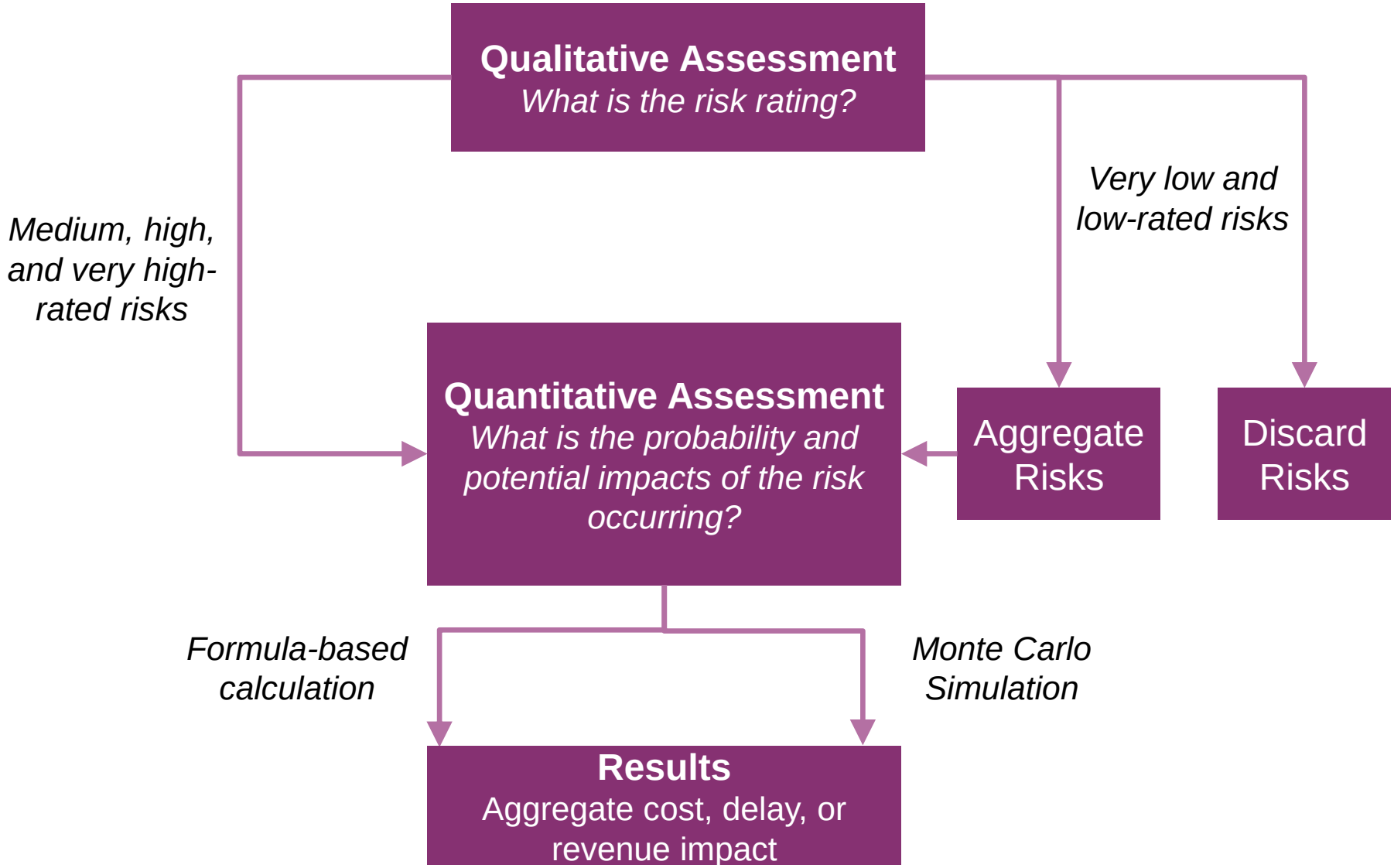
Questions?

Submit a question using the chat box

Lesson 3

Risk Assessment

Risk Assessment Process Overview



Key Inputs

- Probability of risk occurrence
  - Qualitative – very low, low, medium, high, very high
  - Quantitative – % probability (0% - 100%)
- Scale of impact if risk occurs
  - Qualitative – very low, low, medium, high, very high
  - Quantitative – dollar amount or number of days of delay

Qualitative Risk Assessment

- Risk Matrix

Representative Cost Impact Assessment Matrix

		Cost Consequence				
		5	4	3	2	1
Probability	**Scale**	> 25%	10% - 25%	3% - 10%	1% - 3%	<1%
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Representative Schedule Impact Assessment Matrix

		Schedule Consequence				
		5	4	3	2	1
Probability	**Scale**	> 365 days	120 - 365 days	30 - 120 days	7 - 30 days	< 7 days
	5 - > 70%	High	High	High	Medium	Low
	4 - 40% - 70%	High	High	Medium	Medium	Low
	3 - 20% - 40%	High	Medium	Medium	Low	Low
	2 - 5% - 20%	Medium	Medium	Low	Low	Low
	1 - 0% - 5%	Low	Low	Low	Low	Low

Quantitative Risk Assessment

- Formula-based Risk Assessment (VDOT example)
  - Impact = Probability X (Min.+ Max.+ 4 * Most Likely) / 6
- Example:

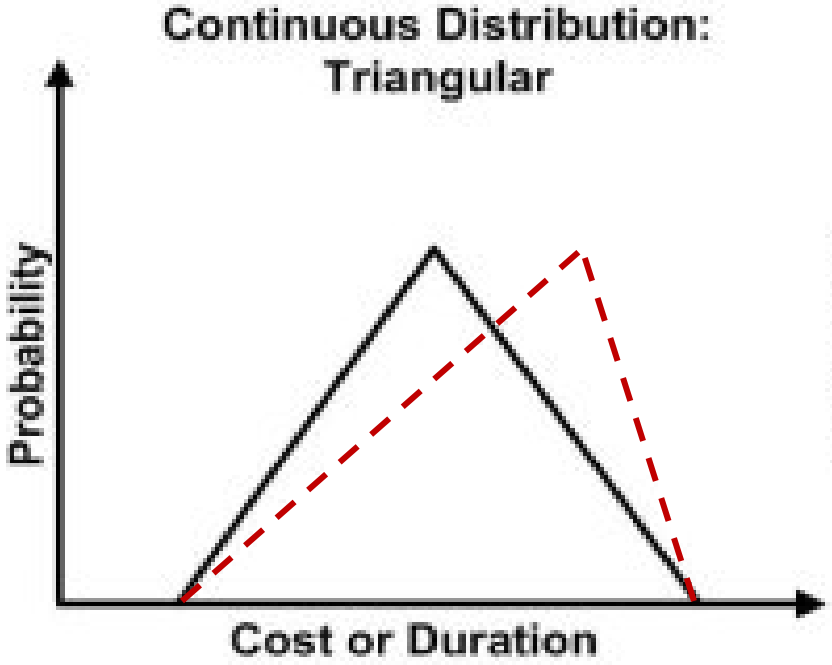
	Risk 1	Risk 2	Aggregate
Probability	50%	80%	
Consequence (min.)	$1 M	$0.5 M	
Consequence (max.)	$5 M	$1.5 M	
Consequence (most likely)	$4.5 M	$1.0 M	
Expected impact of risk using VDOT formula	0.50 X $24M / 6 = $2 M	0.80 X $6M / 6 = $0.8 M	$2.8 M

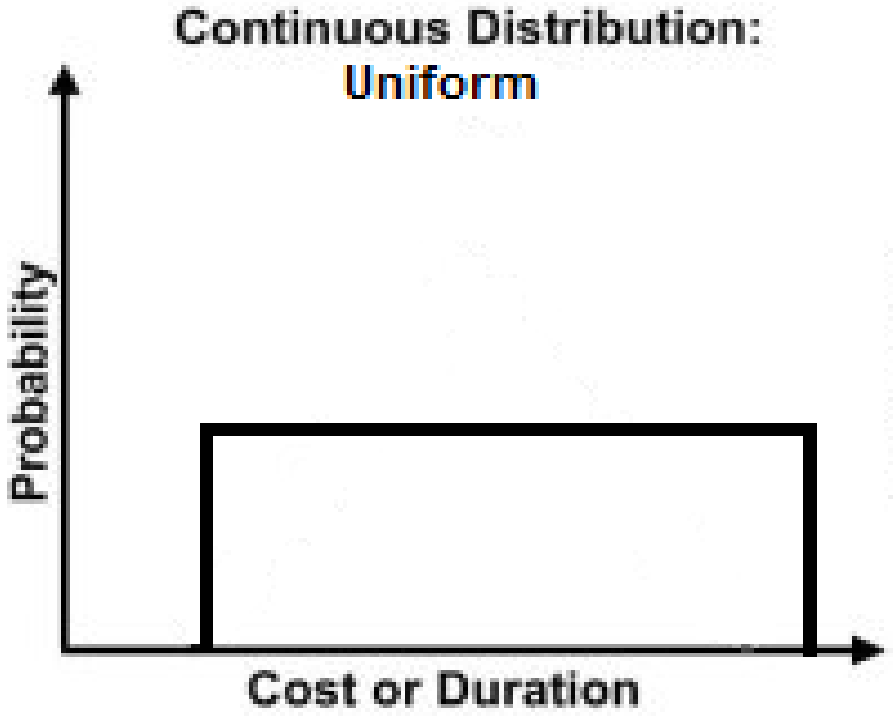
Quantitative Risk Assessment (Cont.)

- Monte Carlo simulation
  - Simulation of large number of scenarios based on probabilities of risk occurrence and probabilities of magnitude of risk impact
- Example:

	Risk 1	Risk 2
Probability	50%	80%
Consequence (min.)	$1 M	$0.5 M
Consequence (max.)	$5 M	$1.5 M
Consequence (most likely)	$4.5 M	
Type of probability distribution of consequence	Triangular	Uniform

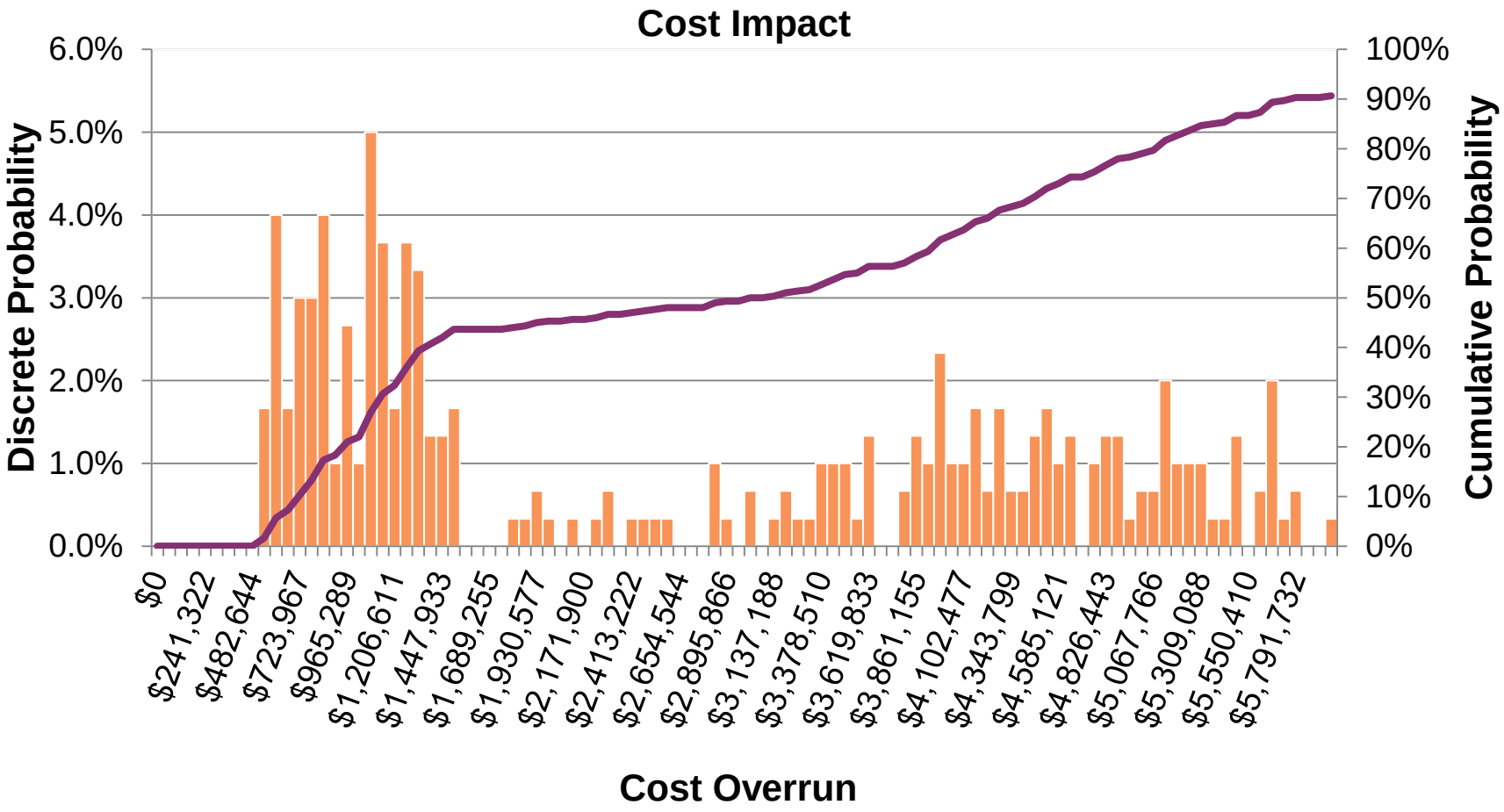
Simple Probability Distributions





Quantitative Risk Assessment

- Monte Carlo Simulation Results



Quantitative Risk Assessment (Cont.)

- Cost Impact Outputs

Cost Risk Results (Real Dollars)		% of Cost Risk Share		
P10 Impact	$530,061		Public	Private
P70 Impact	$3,970,600	Design Build	20%	80%
P90 Impact	$5,116,119	Operations	0%	100%

Cost Breakdown By Phase			
	P10 Impact	P70 Impact	P90 Impact
Planning	$ -	$ -	$ -
Design	$ -	$ -	$ -
Construction	$ 353,374	$ 3,248,673	$ 3,935,476
Commissioning	$ -	$ -	$ -
Turn-Over	$ -	$ -	$ -
Design Build Subtotal	**$ 353,374**	**$ 3,248,673**	**$ 3,935,476**
Operations	**$ 176,687**	**$ 721,927**	**$ 1,180,643**
Total	**$ 530,061**	**$ 3,970,600**	**$ 5,116,119**

Risk Assessment Challenges

- Estimating risk impacts and probabilities with limited data
  - Avoiding optimism bias
  - Or overestimating PSC risks
- Accounting for correlation among risks
- Accounting for “unknowns”
- Avoiding double-counting of risks
  - Project risks vs. “systematic” risks accounted for in financing risk premiums or discount rates
- Accounting for revenue risks
- Aggregating low probability/low consequence risks
- Accounting for procurement phase risks that are unique to P3s

Test Your Knowledge

True or False:

In quantitative risk assessment, every risk – whether low, medium, or high – is quantified individually with regard to probability and scale of impact.

Questions?

Submit a question using the chat box

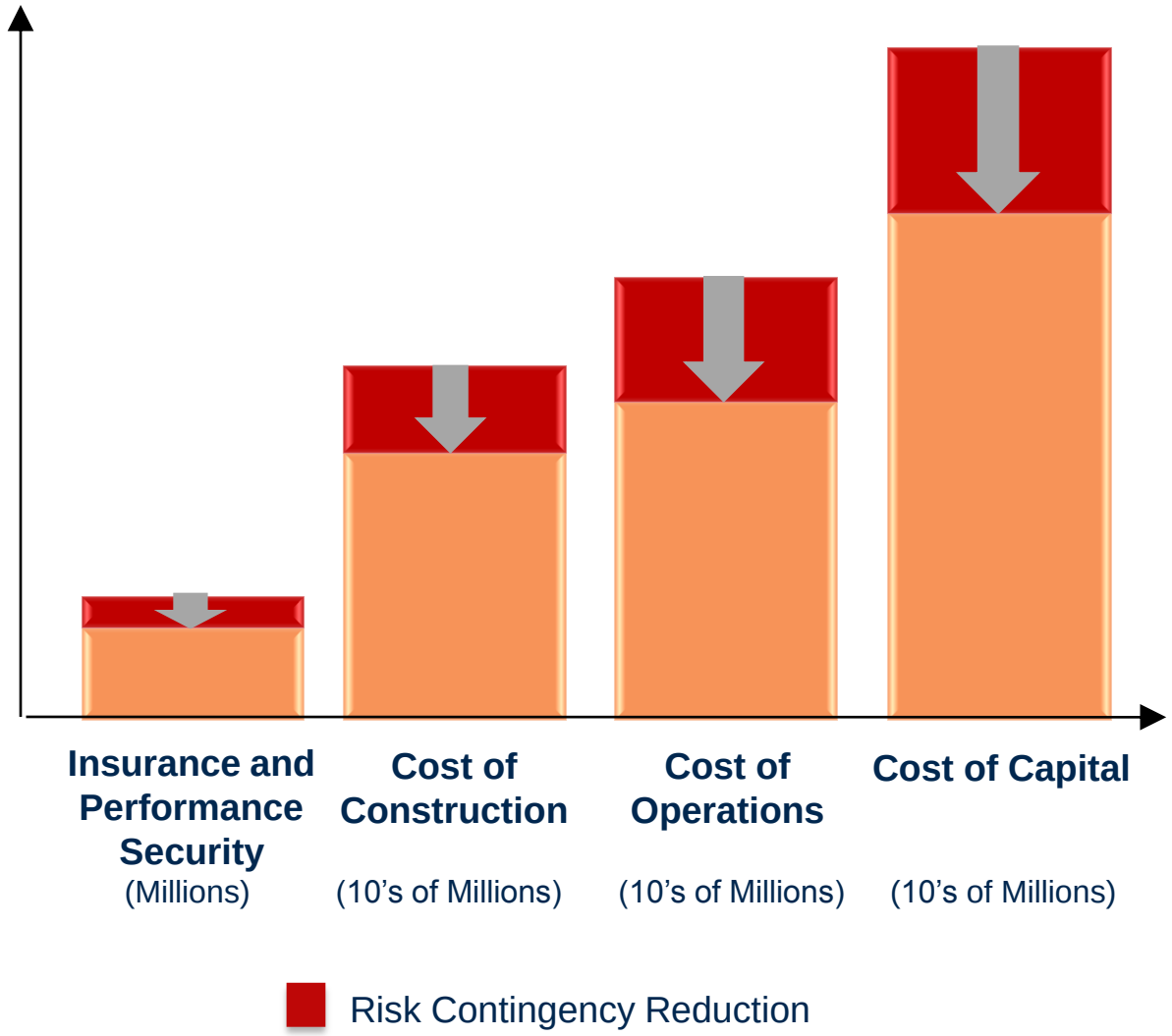
Lesson 4

Risk Allocation

Risk Transfer Principles

- P3s do not transfer *all* project risk
- Risk is allocated to party most capable of managing the risk
  - "Managing risk" may mean insuring that risk
- Risk transfer will increase the bid price of the private sector
- Transferring risks can incentivize performance
- A risk may be shared if neither party is more capable of managing it
- Risks have a value (or cost) that varies over time

Financial Impact of Risk Transfer



Risk Transfer by Procurement Type

Procurement Type	Design Risk	Construction Risk	Financial Risk	O&M Risk	Traffic & Revenue Risk
Design-Build (DB)	X	X			
Design-Build-Finance (DBF)	X	X	X		
Design-Build-Finance-Operate-Maintain (DBFOM) w/Availability Payment	**X**	**X**	**X**	**X**	
DBFOM w/Toll Concession	**X**	**X**	**X**	**X**	**X**

Port of Miami Tunnel
Risk Allocation Example

Risk Category	FDOT	Private	Shared
Political	X		
Financial		X	
Traffic and Revenue	X		
Right of Way	X		
Planning and Permitting			X
Utilities			X
Procurement	X		
Construction		X	
Operations and Maintenance		X	
Hand-Back		X	
Force Majeure			X
Change in Law	X		
Geotechnical			X

Test Your Knowledge

True or False:

The goal in risk allocation is to transfer as much risk as possible to the private partner in a P3.

Questions?

Submit a question using the chat box

Lesson 5

Risk and Value for Money

What is Value for Money?

- **Value for Money (VfM)**
  - The optimum combination of life cycle costs and quality of a good or service to meet the user's requirements
  - Expressed as cost difference (dollars or %) between conventional and P3 procurement
- **VfM Analysis**
  - Quantitative analysis to compare the financial impacts of procurement alternatives for a project
  - Compares *present value* of costs for P3 vs. present value of costs for conventional project delivery
  - Considers value of transferred and retained risks under different procurement options

Value for Money Analysis Steps

1. Identify potential procurement options
2. Identify, monetize and allocate project risks
    1. Risk identification
    2. Risk quantification
    3. Aggregate risk valuation
    4. Risk allocation
3. Apply risk values to expected cash flows over project lifecycle in the public sector comparator (PSC) and P3 option (“shadow bid”)
4. Discount cash flows to calculate net present costs of PSC and Shadow Bid
5. Compare public sector comparator to P3 option
6. Consider qualitative factors

Hypothetical Example

- Conventional procurement – Design-Bid-Build (DBB)
- P3 options – 23-year Design-Build-Finance-Operate-Maintain (DBFOM) concession, including 3-year design-build phase, with:
  - Availability payment (option 1)
  - Toll (option 2)
- Illustrative assumptions:
  - Risks transferred to P3 concessionaire are managed at 50 percent lower cost
  - P3 concessionaire may increase toll revenue by 5 percent for toll concession (opportunity)
  - Future cash flows discounted using public sector borrowing rate

Valuation of Transferrable Risks

Real dollar values	Conventional	P3-Avaliability	P3-Toll
Value of threats	**-$100 M**	**-$50 M**	**-$50 M**
Year 1 cash flow impact	-$20 M	-$10 M	-$10 M
Year 2 cash flow impact	-$70 M	-$ 35 M	-$ 35 M
Year 3 cash flow impact	-$10 M	-$5 M	-$5 M
Value of opportunities	**--**	**--**	**+$200***
Year 4 through 23 cash flow impact			+$10 M per year

*Note that the opportunity for additional revenue can reduce the bid price of the concessionaire, thus can represent a cash flow increase for the public agency also.

Nominal Cash Flows of Transferrable Risks

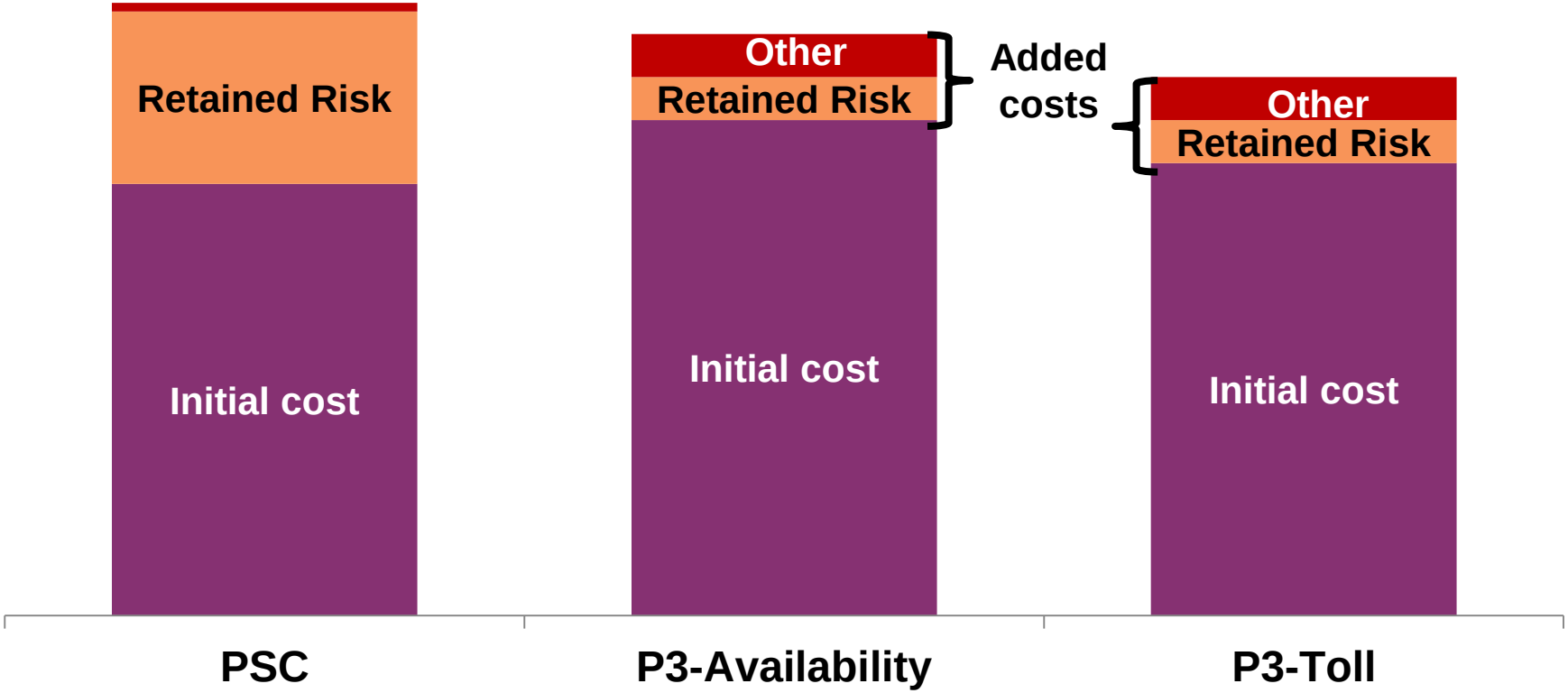
Nominal dollar values at 3% annual inflation rate	Conventional	P3-Avaliability	P3-Toll
Threats (negative risks)			
Year 1 cash flow impact	-$20.6	-$10.3	-$10.3
Year 2 cash flow impact	-$74.3	-$37.1	-$37.1
Year 3 cash flow impact	-$10.9	-$5.5	-$5.5
Opportunities (positive risks)	--	--	
Year 4 cash flow impact			+$11.3
Year 23 cash flow impact			+19.7

Present Value of Transferrable Risks

5% nominal discount rate applied to nominal cash flows	Conventional	P3-Avaliability	P3-Tolll
Threats (negative risks)			
Year 1 cash flow impact	-$19.6	-$9.8	-$9.8
Year 2 cash flow impact	-$67.4	-$33.7	-$33.7
Year 3 cash flow impact	-$9.4	-$4.7	-$4.7
Subtotal	**-$96.4**	**-$48.2**	**-$48.2**
Opportunities (positive)			
Year 4 cash flow impact			+$9.3
Year 23 cash flow impact			+$6.4
Subtotal for 20 years			**+$155.2**
Present value of risks	**-$96.4**	**-$48.2**	**+$107.0**

How Does Risk Affect VfM?

- Transferred risks increase Initial Cost of P3 options, but retained risks in conventional procurement (PSC) may make it more costly than P3 options overall



NOTE: This figure is for demonstration purposes only. One should not conclude that a P3-Toll concession is less costly than a P3-Availability concession.

Audience Feedback

Has your agency conducted a value for money analysis?

- Yes
- No
- Not sure

Questions?

Submit a question using the chat box

Lesson 6

Using the Risk Assessment Tool

Accessing the Risk Assessment Tool

- P3-VALUE tools posted to FHWA IPD website:
  - http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm
- Users should refer to the relevant supporting documentation when opening and navigating the tool
- Send questions and comments to P3-VALUE@dot.gov

Supporting Documentation

- **Orientation Guide**
- **User Manual and Quick Start Guide**
  - *Risk Assessment Tool User Manual* provides technical guidance, including a two-page "quick-start guide" for exploring the tool
- **Primer**
  - *Risk Assessment for Public-Private Partnerships: A Primer* explains the basic concepts involved in risk assessment
- **FAQs and Troubleshooting Guide**
- **Guidebook (under development)**
  - *Risk Assessment & Allocation for Public-Private Partnerships Guidebook* will provide an advanced understanding of the practical applications and challenges of assessing P3 project life cycle risks

Getting Started with the Tool

Introduction & Quick-Start Guide	• Users must accept the acknowledgement to access the tool. Instructions on how to use the Risk Tool are also provided.
Table 1. Model Assumptions	• Allows users to input project data that can serve as a reference for determining the values in the quantitative risk assessment and which affect the schedule impact outputs.
Table 2. Definitions	• Defines key terms used throughout the Risk Tool and contains pre-defined inputs that enable the tool to operate.
Table 3. Risk Assessment Matrix	• Provides an example Cost Impact Matrix and Schedule Impact Matrix that support the qualitative risk assessment.
Table 4. Risk Register	• The outcomes from each stage of the risk assessment process are captured here.
Tables 5-8. Outputs	• Display the total risk impacts generated from the risk assessment process.

Using the P3-VALUE Tool

- Risk Register

1.Risk Identification					
Risk Number	Risk Category	Impact Phase	Risk Type	Description	Consequence of Risk
Technical Risks					
1	Environmental	Construction	Threat	The project is in marshy ground that is prone to flooding and there have not been many boreholes. Later investigations may uncover worse ground than that assumed in preliminary engineering. Excavations at the site of major may result in foundations have to be reinforced / redesigned	Change in design during early stages will require update of cost estimate. Changes on site could result in increase in project costs and potential delay to construction. Change in design during early stages will require update of cost estimate.

Using the P3-VALUE Tool

- Qualitative Risk Assessment

2.Qualitative Risk Assessment				
Probability Rating	Cost		Schedule	
	Consequence	Risk Rating	Consequence	Risk Rating
5	2	Medium	2	Medium

Using the P3-VALUE Tool

- Quantitative Risk Assessment

3.Quantitative Risk Assessment								
Probability Percentage	Schedule Impact (days)				Cost Impact ($)			
	Distribution	Min	Most Likely	Max	Distribution	Min	Most Likely	Max
80%	Triangular	15	20	30	Triangular	$ 8,340,950	$ 16,681,900	$ 83,409,500

Using the P3-VALUE Tool

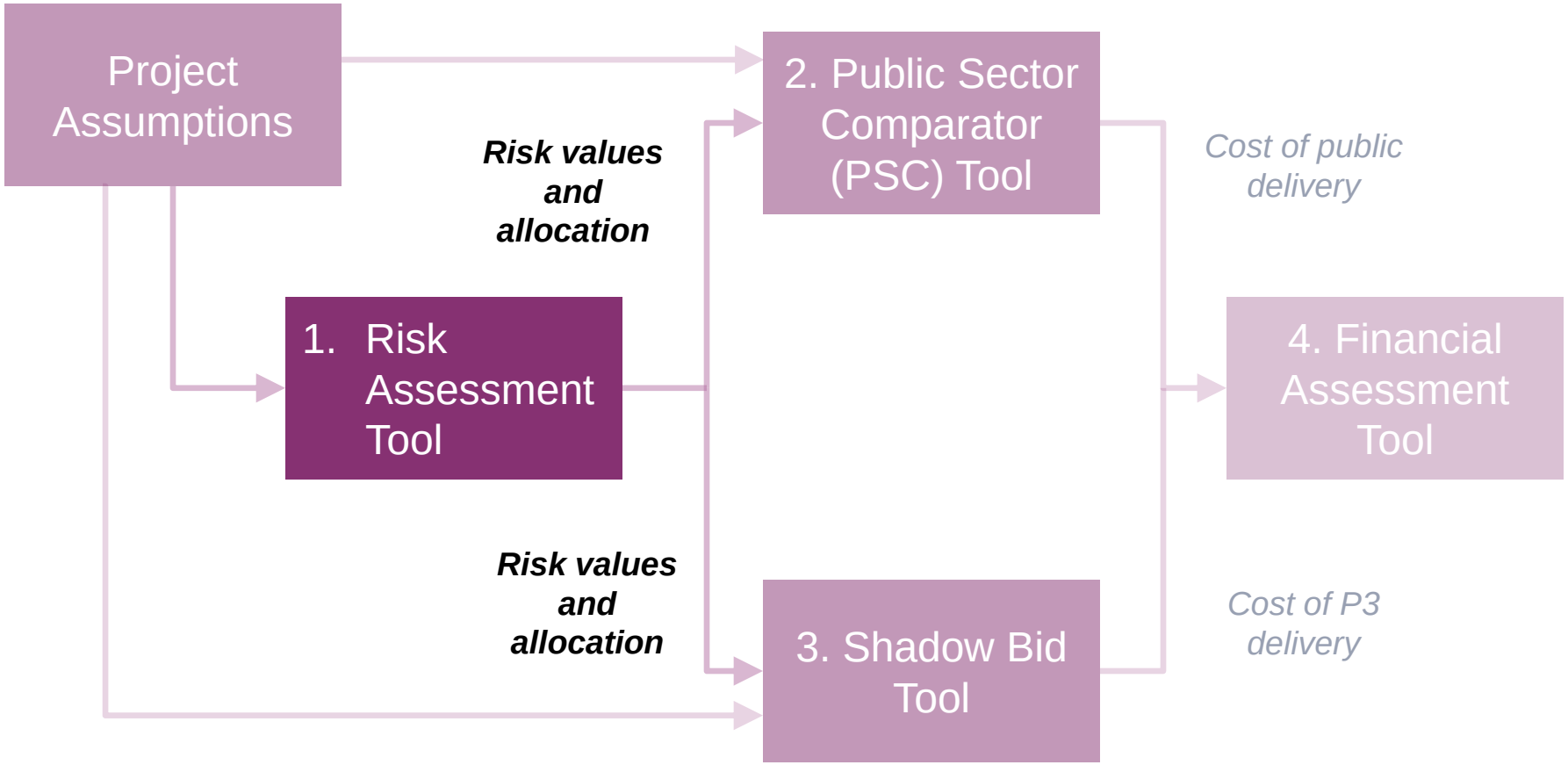
- Risk Allocation & Mitigation

4.Allocation & Mitigation		
Risk Allocation (%)		Risk Mitigation
Public	Private	
20%	80%	Perform additional borings before substantially progressing the design

Risk Assessment Tool Limitations

- Risk Assessment Tool is not suitable for all types of potential scenarios
  - Monte Carlo Simulation does not accommodate revenue risks
- Risk Assessment Tool assumes all risks are independent, with no correlation between the risks
- Risk Assessment Tool does not aggregate lower-rated risks
  - Users can do an “off-sheet” calculation if the impacts of those aggregated risks represent a more significant risk

P3-VALUE Tools



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Questions?

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Course Summary

Course Recap

Lesson 1	P3s and Risk
Lesson 2	Risk Management Process
Lesson 3	Risk Assessment
Lesson 4	Risk Allocation
Lesson 5	Risk and Value for Money
Lesson 6	Using the Risk Assessment Tool

Resources

IPD's P3 Website:
http://www.fhwa.dot.gov/ipd/p3/

FHWA Risk Assessment Primer:
http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_risk_assessment_primer_122612.pdf

FHWA Risk Valuation and Allocation Factsheet:
http://www.fhwa.dot.gov/ipd/pdfs/p3/factsheet_02_riskvalutationandallocation.pdf

P3-VALUE Website:
http://www.fhwa.dot.gov/ipd/p3/toolkit/index.htm

P3-VALUE Risk Assessment Tool:
http://www.fhwa.dot.gov/ipd/p3/toolkit/analytical_tools/index.htm

P3-VALUE Risk Assessment User Manual:
http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_value_riskassessment_manual_v1.pdf

Upcoming P3-VALUE Training

- **July 11:** Public Sector Comparator/Shadow Bid 201
- **Aug. 7:** P3 Financial Assessment 201
- **Aug. 23:** P3 101
- **Sept. 5:** P3 Evaluation Overview
- **Sept. 19:** P3 Project Risk Assessment 201
- **Oct. 3:** Public Sector Comparator/Shadow Bid 201
- **Oct. 17:** P3 Financial Assessment 201

To register, please visit
http://www.nhi.fhwa.dot.gov/resources/webconference/eventcalendar.aspx

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Questions?

Submit a question using the chat box